BTCS-401 Operating Systems

Time: 3 hrs **Max.Marks: 60**

Instructions to Candidates:

1) **Section-A is compulsory consisting Ten questions carrying Two marks each.**
2) **Section-B contains Five questions carrying Five marks each and students have to attempt any Four questions.**
3) **Section-C contains Three questions carrying Ten marks each and students has to attempt any two questions.**

Section- A

Q-1 Write the short note on the following:

a. Explain major difference between system and user mode.
b. What are the differences between load-time and run-time dynamic linking?
c. What is process control block? What information does it contain?
d. What is difference between preemptive and non-preemptive scheduling?
e. What are the major tasks of memory management?
f. Describe the terms: internal and external fragmentation.
g. What is the conceptual difference between fixed-size partitioning and paging?
h. What is Belady's anomaly?
i. What is thrashing? Why is TLB used in paging scheme?
j. Suppose a logical address LA = (8400901)10 and 4 KB pages. Derive the directory number and the page number. (2*10)

Section- B

Q-2 Suppose a 32-bit addressing system with 4 KB pages. Answer the following:
(a) Show the structure of the logical address
(b) How many page directories have the system?
(c) What is the size of page directory entries?
(d) How many page tables have the system?
(e) What is the size of page tables?
(f) How many pages are required for each page directory or page table?
(g) Describe page table and page directory entries (size, fields)
(5)

Q-3 (a) Provide the solution for Dinning Philosopher's problem using semaphores with no busy waiting. (3)
(b) Show why and how is busy waiting supported in hardware? (2)

Q-4 What is page fault?
(a) When a page fault occurs?
(b) How many times can a page fault occur in the case of a tree-address instruction?
(c) Describe the actions of a page fault handler (give a simplified pseudo-code)
(d) What is page fault rate? (5)

Q-5 Suppose that the following processes arrive for execution at the times indicated. Each process will run the listed amount of time. In answering the questions, use non-preemptive scheduling and base all decisions on the information you have at the time the decision must be made.

Process	Arrival Time	Burst Time
*P*1	0.0	8
*P*2	0.4	4
*P*3	1.0	1

a. What is the average turnaround time for these processes with the FCFS scheduling algorithm?

b. What is the average turnaround time for these processes with the SJF scheduling algorithm?

c. The SJF algorithm is supposed to improve performance, but notice that we chose to run process *P*1 at time 0 because we did not know that two shorter processes would arrive soon. Compute what the average turnaround time will be if the CPU is left idle for the first 1 unit and then SJF scheduling is used. Remember that processes *P*1 and *P*2 are waiting during this idle time, so their waiting time may increase. This algorithm could be known as future-knowledge scheduling. (5)

Q-6 (a) What causes a process/thread to change the state?

i. From running to ready?
ii. From ready to running?
iii. From running to blocked?
iv. From blocked to ready? (3)

(b) Describe dynamic partitioning. What is the main problem in dynamic partitioning? How is it solved? (2)

Section- C

Q-7 Consider the following set of processes, with the length of the CPU-burst time given in milliseconds:

Process	Burst Time	Priority
*P*1	10	3
*P*2	1	1
*P*3	2	3
*P*4	1	4
*P*5	5	2

The processes are assumed to have arrived in the order *P*1, *P*2, *P*3, *P*4, *P*5, all at time 0.

a. Draw four Gantt charts illustrating the execution of these processes using FCFS, SJF, a non-preemptive priority (a smaller priority number implies a higher priority), and RR (quantum = 1) scheduling.

b. What is the turnaround time of each process for each of the scheduling algorithms in part a?

c. What is the waiting time of each process for each of the scheduling algorithms in part a?

d. Which of the schedules in part a results in the minimal average waiting time (over all processes)? (10)

Q-8 (a) Consider the following snapshot of a system:

	Allocation	*Max*	*Available*
	A B C D	*A B C D*	*A B C D*
*P*0	0 0 1 2	0 0 1 2	1 5 2 0
*P*1	1 0 0 0	1 7 5 0	
*P*2	1 3 5 4	2 3 5 6	
*P*3	0 6 3 2	0 6 5 2	
*P*4	0 0 1 4	0 6 5 6	

Answer the following questions using the banker's algorithm:

a. What is the content of the matrix *Need*? (5)

(b) Why are segmentation and paging sometimes combined into one scheme? (5)

Q-9 An operating system supports a paged virtual memory, using a central processor with a cycle time of 1 microsecond. It costs an additional 1 microsecond to access a page other than the current one. Pages have 1000words, and the paging device is a drum that rotates at 3000 revolutions per minute and transfers 1 million words per second. The following statistical measurements were obtained from the system:

- 1 percent of all instructions executed accessed a page other than the current page.
- Of the instructions that accessed another page, 80 percent accessed a page already in memory.
- When a new page was required, the replaced page was modified 50 percent of the time.

Calculate the effective instruction time on this system, assuming that the system is running one process only, and that the processor is idle during drum transfers. (10)